LOOSE BODIES IN THE KNEE JOINT.

WITH REPORT OF CASES.

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The Corpora Libera Articulorum, the Corpora Mobilia, the Mures Articuli, the Gelenkmaus, of the Germans; the Corps Etranger Articulaires, of the French, and the Loose or Floating Bodies of the English, have been classified into: *a*, Those in normal joints, or if the joint is diseased, this disease is the result of the presence of the floating body; *b*, those in pathological joints, being the result of such pathology.

But in many cases it has been difficult, if not impossible, to accurately determine with which of these subdivisions a certain body should be classed. In consequence, they have been divided, more practically, according to their composition, as follows:

1, Those consisting of foreign material, fatty tissue, fibrous tissue, fibrin, etc. 2, Those composed of bone, cartilage, or a combination of these two.

A transition of these bodies from class 1 to class 2 has been suggested, and undoubtedly this change does take place.

In class 1, perhaps the most important are the "Rice Bodies," "Melon Seeds," and the "Corpora Orysoidea," which as a rule indicate the tubercular nature of the change. These bodies occur not only in joints, but in tendon sheaths, and bursae, most frequently in regions other than the knee. They vary in size from 1/4 to 1/2 inch in diameter, and in color, appearance, and consistency resemble boiled rice. Histologically they are found to be composed of fibrin and are practically structureless. They are supposed to be formed, by the exfoliation of particles of necrotic tissue, by a separation of villous or papillomatous growths from the synovial membrane, followed by coagulation necrosis, or by the fibrinoplastic properties of the tubercle bacilli by which granulations are converted into fibrous tissue.

The lipomata in connection with the knee joint have recently received attention that has evidently been long due them, by numerous writers and especially by Hoffa[1] in his paper before the American Medical Association in 1904. In the cases reported in this contribution to the subject the bodies were of either bone or cartilage, and therefore the discussion will be limited to those bodies coming under that class.

According to Mueller,[2] Ambrose Pare, of ligature fame, in 1558, was the first to remove a loose body from the knee joint although its presence was unsuspected until the joint was opened for the purpose of draining an abscess. This particular body happened to be of cartilage, and hence the frequent use of the name "floating cartilage," many times regardless of its histological structure. In 1691, Pechlin was the first to describe the symptoms accompanying this condition. Subsequently cases were reported by Monro in 1726, Simpson in 1736, and by Morgagni in 1746, after which they were no longer considered a rarity.

In 1793 John Hunter[3] considered these bodies at length, and theorized upon their formation in a paper read by Sir Everard Home, and published in Hunter's work entitled "The Blood, Inflammation and Gunshot Wounds." An unusual case is cited in which many such bodies were found in a pseudo-articulation following a non-union of the humerus. He then attributed their origin to the presence of small coagulæ of blood in the joint.

Rainey and Solly[4] in 1848 presented theories as to the formation of these floating substances within the joint. After a careful examination of the bodies and the lining membrane of the joints, they conclude that the glands of the synovial membrane instead of secreting synovia, under some influence, produce cartilage instead, which becomes converted into imperfectly formed bone.

Since then many theories have been brought forward to explain the presence and the formation of such bodies, and even at the present time these points are not definitely known. Among the following will be found the usual explanations:

a. A dry arthritis with an overgrowth of the margins of the articular cartilages.

b. Bony growths that have broken away from their attachments.

c. Infarction of the articular cartilage, with final separation of the infarct.

d. Plate of bone formed outside of the joint and then invaginated.

e. Chondrification and calcification of enlarged synovial villi.

f. An irritation and growth of embryonal cartilage and bone cells in the synovial fringes.

g. Concretions similar to biliary or cystic calculi, the nucleus being either a blood clot, a torn synovial fringe, a foreign body, a lipoma, or a piece of articular cartilage.

h. A portion of articular surface or semilunar cartilage broken off by direct injury.

i. A portion of articular surface or semilunar cartilage damaged by trauma, and subsequently becoming separated.

Trauma is considered by many authorities, notably by Barth,[5] and by Vollbrecht,[6] to be the cause of these bodies, but some observers, such as Sir George Humphry,[7] doubt that they are ever caused by traumatism. It is certain that in many cases a history of injury is quite doubtful and in some instances absolutely negative.

Various experiments have been undertaken to determine the relationship existing between these bodies and a previous injury to the joint. Kragland[8] found that upon the cadaver it was impossible to detach a fragment of articular cartilage simply by a blow; an area was loosened in this manner, but in order to separate it, a prying force had to be applied. Codman[9] in a series of similar experiments arrived at the same conclusion.

But Burghard[10] in 1892 found that an oblique blow upon the internal condyle, with the knee flexed, may, with some difficulty, cause a complete separation of a piece of the articular cartilage. Cornil and Coudray[11] in experimenting upon dogs found that these bodies of traumatic origin became united to the articular extremity of the bone or to the synovial membrane. In one case eight days after the separation of a fragment of the articular surface of the bone, with chisel and mallet, this piece was found united to the condyle by an osseous bridge. H. Rimann [12] found the same result after conducting similar experiments upon goats and dogs. These experiments show that the influence of trauma in causing the formation of these joints is still *sub judice*.

The experiments of Kraglund and of Codman tend to substantiate the explanation offered by Koenig,[13] *i.e.*, the traumatism injures and depresses a certain portion of the articular surface, and that this portion subsequently becomes detached by a pathological process, a fatty necrosis, called by Koenig " Osteochondritis dessicans."

Sir J. Paget [14] described practically the same process and called it "Quiet Necrosis." Mr. Teale,[15] at about the same time, mentions the same condition but without giving it a special name. Other names that have been applied are " Spontaneous demarcation," by Klein,[16] and " Ostitis," by Kraglund.

Poulet and Vaillard,[17] after a very complete and extensive study of this subject, arrive at practically the same conclusion relative to traumatism as an indirect etiological factor.

M. L. Harris,[18] in discussing this explanation after drawing attention to the fact that Koenig's paper was written fifteen years ago, said: " There is almost no one who reports a case that does not reach the conclusion that Koenig was wrong." Still we find that Grüder [19] has recently reported a case under the title " A Contribution to the Origin of Free Joint Bodies through Osteochondritis Dessicans of Koenig." Martens[20] makes an extensive report from Koenig's clinics at Gottingen and Berlin, including clinical and operative histories with microscopic examinations of the bodies removed. And in the present year, Koenig[21] himself strenuously supports his previous position in a reply to the experiments and writings of Rimann and Cornil and Coudray.

In the absence of a positive history of injury the frequent occurrence of this condition in both knees, while not excluding traumatism, does seem to render such an explanation less plausible. Bowlby,[22] Clutton [23] and Weichselbaum [24] each records cases in which a loose body exactly similar in shape, size and position was found in the knee joints of both limbs. Bennett [25] explains the not uncommon involvement of both joints, as being due to the sprain or sudden twisting of the second joint which frequently takes place in the constant effort, made unconsciously, to protect or favor the joint first affected.

That these floating bodies of the joint are rarely of purely traumatic origin, was shown by Halstead,[26] who in 1895, after a careful review of the literature, found only three cases of this character, and one of these was doubtful. Koenig, Bruns, and many German authorities claim that spontaneous traumatic separation never occurs. But Burghard [10] reports one undoubted case of this character and, while admitting their extreme rarity, mentions five similar ones that he collected from the literature.

Max Schüller [27] collected 143 cases of floating bodies in the joints and found that 85 were of distinctly traumatic origin, 39 were due to pathological changes, and 19 were unknown. But in these the question as to the direct traumatic separation of the fragment is not entered into. In many instances it is extremely difficult to determine the role played by traumatism. The movable body may lie dormant and not until there has been some injury to the knee do the symptoms present themselves. Or, in accord with Koenig, the osteochondritis dessicans may have all but separated the particle of articular cartilage when a comparative slight trauma completes the work.

The presence of a defect in the articular surface, approximately equal in size to the floating body, has been frequently noted. Instances beautifully illustrating the origin of these bodies from such defects are related by Codman [9] and Lane.[28] Harris [18] mentions a case in which the floating body accurately fitted into the defect, and the history of the case extended over thirty-two years.

The defect is usually situated on the internal condyle, because when the knee is flexed the patella does not protect this in so complete a manner as it does the external condyle. But the external is sometimes injured, and MacCormack[20] mentions the case of Bruce Clark, in which the defect was on the articular surface of the patella. A discrepancy in the size or shape may exist between the body and the defect. This may be explained by a partial or beginning regeneration of the articular surface, or by a change in size of the detached fragment. Usually both of these factors will have been responsible for the lack of symmetry between the two.

The defect may be absent, owing to the origin of the body from some other source, or to a complete regeneration of the articular surface (as in Case II).

In a case reported by Wilson[30] in which he removed the body one year after the injury, critical examination of the condyles of the femur was negative, but on the posterior internal portion of the articular surface of the tibia, there seemed to be an irregularity which led to the surmise that this point was the origin of the body removed. Subsequent repair had largely obliterated any cavity that might have been made at the time of the accident.

This loss of substance in the articular surface of the bone even if corresponding, in size and shape, to the loose body does not necessarily mean that the latter originated from the former. Halstead[26] has brought out the point that the free body may possibly originate from some other source and then by pressure atrophy cause a depression in the articular surface, similar in size and shape to the movable body. In the case of Fairchilds[31] a bullet was removed from the knee joint after having been in the joint or its neighborhood for many years. The foreign body had worn a groove into, but not through, the articular cartilage.

The history of these fragments after separation is another subject of much speculation. That they increase in size can not be doubted. Cornil and Coudray[11] mention two fragments that measured 7 mm. and 8 mm. in their longest diameter, but which measured 12 mm. and 13 mm. at the end of 1 and 1½ months. This augmentation in size they attribute sometimes to the production of fibrous tissue and sometimes to the formation of new fibro-cartilage. Other explanations are that the increase in size is due to imbibition from the synovial fluid, to the deposit of layers of fibrin from the synovia, or to the deposit of lime salts. Poulet and Vaillard[17] have shown that the fragment which at the time of its origin consists of bone and cartilage, becomes surrounded on all sides by cartilage, and that this newly-formed cartilage differs from the articular cartilage in being more embryonal and irregular.

In Wilson's[30] case the bone removed was found to have two surfaces covered with cartilage. The firm attachment to the tibia, and its vascularity, indicated to Wilson that it had formerly been much smaller.

Codman[9] points out that the growth is chiefly in the cancellated bone, which may at times completely surround the cartilage, and in many cases that the cellular elements are still capable of being stained, which seems to point toward the activity of the osteoblasts. But to show that this power of the bone has not as yet been definitely determined we quote Codman; "*A priori,* however, one would think that growth by concretion and the slow deposit of lime salts would be more likely."

Cornil and Coudray[11] claim that one of the first changes noticed in all the traumatic foreign bodies was a disappearance, more or less rapid, and more or less complete, of the living cells of the bony portion of the fragment. Where there has been noted a reproduction of either the osseous or the cartilaginous cells the nutrition for this growth has been supposed to be derived from the synovial fluid. Barth[5] thinks that the necessary nutriment is supplied through adhesions to the capsule. The pedicle, when present, has so often been found to be non-vascular, that a source of blood supply from this attachment is not to be expected Yet Barwell[32] thought that many of these bodies originated outside of the joint proper and likens the pedicle to a mesentery.

Blood-clots have undoubtedly become impregnated with calcium salts, and foreign bodies have been surrounded by osseous or cartilaginous material. For example, in the case of Shaw[33] the loose body was found to have, as a nucleus, a fragment of a needle. In this conection, Fairchild's[31] case is interesting, A Minié ball weighing 440 gm. was removed from the knee joint twenty-nine years after receiving a gunshot wound, but only three or four years after the onset of definite symptoms referable to the knee. In a personal communication Dr. Fairchild states that the ball was not covered with a deposit, neither was it bright, but of a dull, dead color.

The number of bodies that have been found within the joint varies greatly. They may be single or multiple and so frequent are they multiple that others should always be searched for. Bland Sutton[34] counted 1532 calcareous granules that were removed from a shoulder joint. Berry[35] removed 1047 from a knee joint from which, four years previously,[36] he had removed 50; he also mentions a case in which Mr. Thomas Smith removed 400 movable masses of cartilage from a knee. Barwell[32] states that nine tenths of these bodies occur in the knee joint, with the elbow being the next frequent site, and Barth,[5] in his classic work entitled " The Origin and Growth of Free Joint Bodies," found reports of cases in the knee, 55; elbow, 8; shoulder, 2; and wrist, 1. Paget[14] mentions a case of the hip joint, and the articulation of the lower jaw has also been found involved. The ankle is rarely affected, but even pseudo-articulations are not exempt, as was seen in the above mentioned case of John Hunter's.[3]

Symptoms.—The symptoms may be very marked, significant, and to a degree almost pathognomonic. The most characteristic symptom is undoubtedly the sudden occurrence of severe sharp shooting pains in the joint, frequently so severe as to cause syncope. And with this pain there is a " locking " of the joint, *i.e.*, an inability to flex or extend the limb. The leg is usually slightly flexed, which is perhaps due to the interposition of the floating body between the articular surfaces, or between the bone and the capsular ligament. Reichel[37] is of the opinion that the body is never caught between the joint surfaces themselves, and cites the case of Lawson in which operation was performed during the attack, and the body was found in this position. In Case I of this series the operation was performed while the joint was locked and the body was found between the capsule and the joint surface. (See Fig. i).

In Case IV (Fig vii) the movable cartilage seemed to occupy a relatively similar position, yet at no time was there locking of the joint. In this case the exact relations of the body were not determined by operation; the body may have been external to the capsule, possibly passing through a tear in the capsule at the time of the injury.

The larger the body, the less acute are the symptoms, although in cases where the large body exists the attack of pain, while not so severe, is more continuous. This is well shown in Case III, in which the bodies are extremely large. The pain had increased with the increase in size though a locking with its accompanying paroxysm had not occurred in many years.

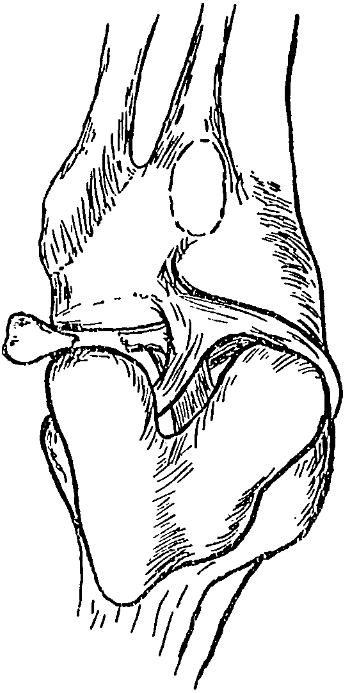

FIG. 7.

The locking may last for a variable time, from an instant to a day or two. An acute synovitis usually follows and may persist for a number of weeks. Occasionally the synovitis may be absent, if the locking has been of very short duration. These attacks occur at irregular intervals and generally during the interval the joint is approximately normal.

With the presence of a palpable mass in the joint, or in connection with the joint, the above symptoms will lead to an accurate diagnosis, but on the other hand, with the absence of any visible or palpable mass in the neighborhood of the joint, differentiation from the other causes of " Internal Derangement of the Knee" will be arrived at only with great difficulty, if at all.

The different pathological conditions that may be included under the caption " Internal Derangements" have been classified, according to their frequency, by Tenny[38] as follows: Tabs from lubricating apparatus; Erosion of cartilage; Damaged and displaced semi-lunar cartilages; Ruptured ligaments; Free and loose bodies; Villous and papillary synovitis.

Damaged or displaced semi-lunar cartilages are perhaps the most frequent condition confused with the free or loose bodies. This condition was first described by Hey,[39] of Leeds, England, in 1803, and was called " Hey's Internal Derangement of the Knee." It was treated by splints, supports, and appliances. In 1885 Mr. Annandale,[40] of Edinburgh, followed closely by A. W. Mayo Robson,[41] of Leeds, operated for the relief of this condition.

With the adoption of the radical cure, abnormal semilunar cartilages have been assuming a position of more importance. As showing the relative frequency with which these two conditions are encountered, Allingham[42] found 12 cases of loose body and 35 cases of pathological condition of the semi-lunar cartilages in 59 cases operated upon for internal derangement. In 33 operations of this character performed by Robson,[41] 21 were for damaged semi-lunars and 12 for free bodies in the joint. In 106 cases of internal derangement which came to operation, Bennett[25] removed the semi-lunar cartilages 80 times and loose bodies 16 times. In 505 cases of recurrent effusion of the knee joint the same author found obvious symptoms of loose body in 21 cases. That the differential diagnosis between these conditions is at times most difficult will be shown by the following case reported by Hubbard,[43] which had been examined by many men and was frequently diagnosed as a slipping cartilage. The patient was seen by Dr. R. F. Weir, of New York, who, after a careful examination and a knowledge of the history of the case, was of the opinion that the inner semi-lunar cartilage was the seat of the trouble and advised operation. At operation the cartilage was found to be thickened but this was not deemed sufficient to account for the symptoms. Manipulation of the limb allowed the escape of three unsuspected floating cartilages. Allingham [42] cites a case in which his diagnosis of damaged semi-lunar proved at operation to be a loose body.

He gives as characteristics of damaged semi-lunar cartilages: *a*, distinct history of traumatic origin; *b*, well defined site of pain, either internal or external according to the cartilage damaged; *c*, no foreign body palpable; and *d*, no creaking in the joint.

Cotterill [44] makes the point that in damaged semi-lunars full extension is painful, while full flexion is painless. The X-ray may be of value, in that loose bodies will practically always contain bone, and therefore cause a shadow, while the separated semi-lunar, being of cartilage exclusively, will not show in the skiagram.

Under the title "Treatment of Puzzling Knee Affections" Hoffa [45] mentions the cases that were hitherto called "Neuralgia of the Knee," and states that many such cases are due to certain definite pathological changes within the joint, among which he includes free bodies.

In reporting four cases of "Contusion and Laceration of the Mucous and Alar Ligaments and Synovial Fringes of the Knee Joint," Flint [46] mentions a very instructive instance Case IV, in which at examination there was a sensation of something slipping beneath the fingers in the swollen region. At operation, the mucous ligament was found free in the joint with a thickened jagged margin. On manipulating the joint this reddened area comes to be between the outer margin of the patella and the condyle of the femur, and corresponds to the mass felt to slip beneath the finger before the operation.

Indications for Operation.—After the diagnosis is fully established there is no question but that the joint will continue to cause trouble until the offending body is removed. There is always a possibility that the free body may become attached in some cul-de-sac in an out-of-the-way location, and give rise to no further trouble, but such a fortunate contingency rarely occurs in actual practice. If the body is in such a location and giving rise to no disturbance it should not be disturbed. They should not be removed merely because they are present, but because they are causing symptoms and disturbing the function of the joint.

In case of doubtful diagnosis, rest, splints, massage, etc., should be judiciously tried before advising operation. Exploratory incision of the joint is allowable in certain cases. Allingham,[42] in 59 cases operated upon, found nothing abnormal in 3 instances. Bennett[25] made an exploratory incision 12 times in 106 operations and in 5 of these nothing was found to account for the symptoms, but in 2 of these 5 the exploration was followed by relief of the symptoms. Goldthwait[47] advocates incision and explorations not only for the various causes of internal derangement, but also in doubtful cases for diagnosis. The cases of Flint[46] were operated upon for exploratory purposes. Absolute diagnosis was not possible, but it was highly probable that some lesion would be found.

Treatment.—The treatment should be the removal of the offending body. The old classification into treatment by (a) direct incision, and (b) indirect incision, is no longer of practical value, and the second subdivision only of historic interest. Under perfect aseptic environs the operation is practically devoid of danger. The fact that there is danger in the opening of a large joint like the knee is established beyond cavil, but that the danger has been practically removed when operating under favorable circumstances is also well recognized. The joint must be approached with as much care and solicitation as when we invade the peritoneal cavity. These two serous sacs, the peritoneal and the synovial, are similarly susceptible to infection, with the peritoneum being more tolerant. The power of the peritoneum to take care of a certain amount of infection is well known The serous lining of the joint cavities is not so resistant. The absence of a structure analogous to the omentum, " the policeman of the peritoneal cavity," may account in part for this difference. This well-known lack of resistance of the joint makes it necessary to exercise the utmost caution in the operation.

As showing how much disturbances may be caused by invading a large joint even though no sepsis is present, J. H. Barbat,[48] reports a case in which, 48 hours after the removal of a large body, there was great pain, pulse 120, temperature 101 F., with the knee swollen and tender. He removed a skin suture and allowed about two ounces of bloody serum to escape, which on culture media proved to be sterile. More serum was removed two days later, and on the twelfth day the condition was normal. General anesthesia is not always necessary, and the employment of infiltration anesthesia should be considered, if not used, in every case. In Case I the body was removed in a manner perfectly satisfactory to both patient and operator after infiltration with a solution of eucaine lactate gr. 1 to the ounce or normal salt solution, to which was added gtt. 4 of adrenalin chloride 1-1000. Houghton [49] removed a floating cartilage from an extremely neurotic individual after a similar analgesia and even tapped the articular surfaces with a knife without any objection being made by the patient.

The incision of the skin and that in the capsule of the joint should be on different planes, as a safeguard against the extension of a possible superficial infection from without inward. The incision should be located so as to expose the body to be removed and at the same time permit of an examination of the corresponding condyle of the femur. The incision generally employed is longitudinal at either side of the patella but this is not always sufficient to secure all of the bodies especially if they happen to be numerous, situated behind the condules, or attached. In some cases a more extensive operation, with transverse division of the patella and complete exposure may be necessary, as in the case of Lords[50] in which he removed ten bodies. Sir William Banks[51] removed 40 after incising the tendon of the quadriceps and turning down a lower flap which contained the patella. These more serious operations are fortunately but rarely indicated.

The gloved finger may be used to palpate the articular cartilage. In this manner partially detached fragments have been discovered and removed, saving the patient from the necessity of a future operation. In dealing with the knee joint the "fingerless" operation has been insisted upon by many authorities, such as Koenig and Hoffa, but since the introduction and use of rubber gloves, which are essential, it would seem that the objections to digital palpation of the articular surfaces have been overcome.

These floating bodies of the joints are aptly called "gelenkmaus" by the Germans, because of their liability to disappear during the anesthesia or the operation unless such a contingency has been considered and measures taken to prevent it. The suggestion that a needle be passed through the skin and the body in the joint is not always practicable. Elastic constriction of the limb above and below the floating cartilage usually prevents it from slipping into the joint and out of sight at an inopportune moment.

The results following the removal of these bodies show a marked improvement, due without question, to the introduction and practice of aseptic surgery.

Paré[2] was the first (1558) to remove a loose cartilage from the knee joint, after which, removal by direct and indirect incision was performed with increasing frequency. In 1860 Larry[52] collected all of the cases up to that time, 170, of which 117 were successful, 33 died, and 20 were failures. Nine years later Benndorff[32] collected 169 cases, 109 with success, 46 deaths and 14 failures. Barwell[32] found 88 cases between 1860 and 1875, 73 successful, 5 deaths and 10 failures. The failures were ineffectual attempts to operate by the indirect or subcutaneous incision of the capsule, which method has been obsolete for many years.

Müller[2] in 1886 gathered 190 instances of operation for the relief of this condition, with 96 per cent. recoveries and 4 per cent. deaths. Woodward[53] up to 1889 found 104 cases with six bad results, 2 amputations and 1 death. Marsh[54] mentions 72 instances of operative removal of these bodies between the years 1885 and 1895 with no deaths and 10 failures. During these same years Bolton[55] states that no fatal results has been recorded. Cloudot[56] found no death from an operation for this condition reported since 1877. Tenny[38] in 1904 found 297 cases since 1895, with no amputation and no deaths.

These late statistics are certainly interesting and encouraging when compared with the words of Benj. Bell[57] who, in 1787, while speaking of those bodies in the knee joint that are not freely movable said: "In this case I would advise *amputation of the limb.* The remedy is no doubt severe, but it is less painful as well as less hazardous, than the excision of any of these concretions that have been attached to the capsular ligament."

REPORT OF CASES.

Case I.—D. S., male, forty years old, miner, Irish. Previous History: Fracture of right leg above the ankle about eight years ago, recovery perfect. During life he had received many more or less severe sprains, bruises and falls; and in his occupation he had frequently injured his knees, but had no recollection of severely injuring either joint. Present illness began about eight months ago, with an injury to his left knee. While timbering, in a crouched position, his right knee on the ground with the left limb abducted and semi-flexed, the foot on the ground and the knee about six inches above the ground, the force of his blows upon the timbers dislodged some particles of rock and a piece weighing about four or five pounds fell a distance of about ten or twelve feet, and struck his left knee, bringing it forcibly against the ground.

He experienced severe pain in the knee and the entire limb but in about an hour he was able to ride (horseback) to his home. After nursing the joint for a few days, he was able to walk about, but with a decided limp, due to the stiffness and soreness which remained for some weeks. About a week after the accident he consulted a physician who treated him for rheumatism; he became no better, and since the injury the knee had been weak and unreliable, allowing him to work only a few days at a time. The joint was always sore and painful, but at irregular intervals there was a sharp shooting pain with a locking of the joint, lasting a variable time from an instant to half an hour. After these attacks of acute pain, the knee was swollen and tender to touch and painful upon motion. Hot application usually relieved the pain and reduced the swelling.

Six months ago, after one of these attacks of locking of the joint, he noticed a swelling located upon the inner aspect of the knee, at about the lower edge of the patella. Two months ago, after a like attack, a similar swelling appeared about an inch above the head of the fibula. These swellings were about the size of an ordinary bean, hard, immovable, and very tender; they remained visible for about three or four hours in each instance and finally disappeared without the knowledge of the patient. Hot cloths were applied each time, and caused relief from the pain. On February 6, 1904, while splitting wood, he slipped, twisted his knee, and had another attack of acute pain but much severer than the preceding ones. He dragged himself from the yard into the house, and on examining the knee, found a swelling a trifle larger than the previous ones, in the same location that it had assumed at the last attack, *i.e.*, above the head of the fibula. (See Fig. I.)

The writer was called, and examined the joint about one hour after the onset of the attack. The joint was not swollen, mensuration showed both joints to be of the same dimensions, there was no fluid in the joint, the limb was flexed at almost a right angle, the motion was very limited and painful. The entire left knee was very tender, though the pain at this time was greatly lessened to what it had been, hot applications had been continuously applied. The greatest tenderness was in the neighborhood of the small swelling, pressure upon which caused exquisite pain. This mass, a trifle larger than an ordinary bean, was immovable, very hard, and the skin which was not reddened, moved freely over it.

A diagnosis of floating cartilage was made, and its immediate removal advised, but the patient would only consent to operation, on the following day, if the symptoms did not disappear in the

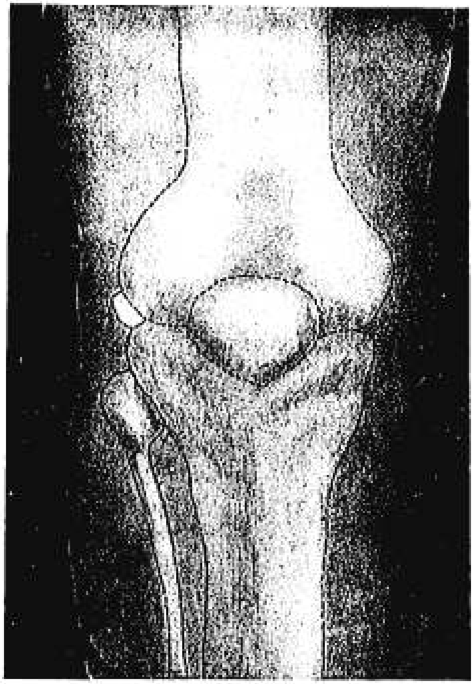

FIG. 1.

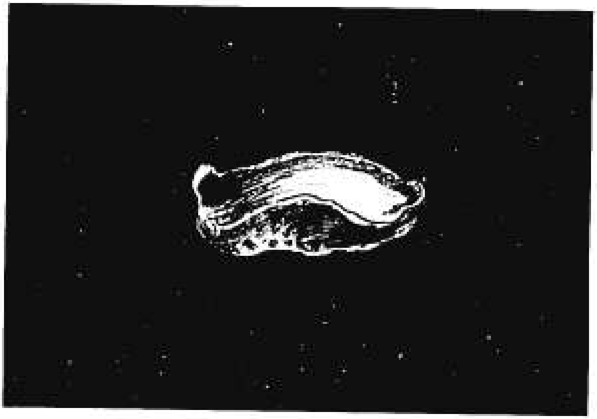

FIG. 2.

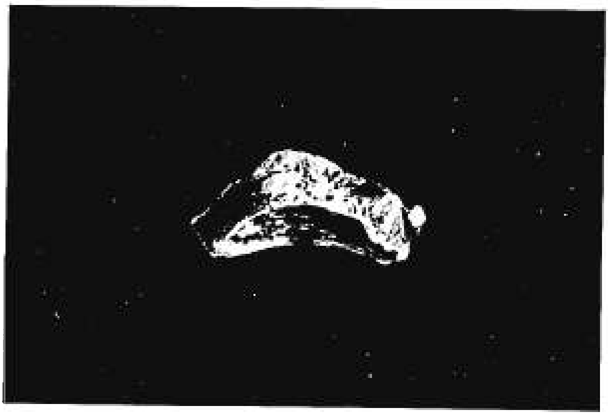

FIG. 3.

mean time. Consequently a hot moist dressing with a posterior splint was applied. On the following day, as the conditions were practically the same, the patient was removed to St. Vincent's Hospital. Operation February 7, 1904, assisted by Dr. J. A. Jeannotte. After the usual preparation and before the incision an elastic band was applied around the knee, above and below the body to be removed, to prevent it from slipping into the joint during the maneuvers that might be necessary in its removal. Anesthesia by infiltration, with eucaire lactate gr. 1, normal salt solution oz. 1, adrenalin chloride, 1-1000 gtt. 4 was perfectly satisfactory.

An incision one inch long was made parallel to the long axis of the limb over the tumor, which was situated an inch above the head of the fibula, Skin fascia, and capsule of the joint were all divided and the mass of cartilage was grasped with a sequestrum forceps and easily delivered. It was then found to be attached by a membranous pedicle, this was ligated, divided, and the cartilage taken away. The capsule was sutured with plain catgut, and the skin with silkwormgut. A collodion dressing applied and the limb put up in plaster paris.

On the seventh day the plaster bandage was taken off and the stitches removed, on the tenth day the patient was discharged from the hospital, with the normal function of the joint. The body that was removed (see Figs. II and III) measured 1.5 cm. in length, .5 cm. in thickness, and .5 cm. in width. Its external surface is convex, bony and rough, with many indentations; the inferior surface concave, bony, and .5 cm. broad; the superior surface is convex, bony and narrow terminating in a distinct ridge. The internal surface is flat and covered with a layer of cartilage about 1 mm. in thickness. At one extremity of this body, the one to which the pedicle was attached, there is found a distinct particle of bone about 1 by 3 mm. in size, and this is held to the larger fragment by the cartilage in which it is embedded.

Two months after his discharge, Mr. S. informed me that he had been entirely well up to a few days previous, when he had an attack very similar to those with which he suffered before the operation, with the exception that the pain was not so severe. A small swelling, about half the size of the body removed, presented itself at the inner and lower aspect of the patella, the location in which he first noticed such a swelling about eight months previous. This swelling was noticeable for about half an hour, and the soreness of the joint was practically all gone the next day. He was told that there was certainly one, and perhaps more such bodies as had been removed still in the joint, and that the next time one presented itself he should come to the hospital at once and have it removed.

Four months later the patient again presented himself and reported that the knee was bothering him considerably. He said that he could feel a swelling down deep in the muscles of the upper portion of the calf of the leg. A few days before his visit, it had returned to its old location, at the inner and outer border of the patella, and had remained there all day, but the following morning it had disappeared and he felt much better. Examination of the knee at this time, was absolutely negative, the joint was apparently normal. The cicatrix of the operation was barely visible and caused no inconvenience.

CASE II.—J. G., male, forty-two years, switchman, American. On March 4, 1904, a locomotive ran over his right leg. He was immediately removed to St. Vincent's Hospital, where an examination revealed a crushing injury to the bones and soft parts of the right leg, which necessitated an amputation above the knee joint. Upon opening the knee joint a large floating cartilage popped out. This body (see Figs. IV and V) resembles a pumpkin seed in size and shape, it is 2.5 cm. long, 1.5 cm. wide and .5 cm. in thickness. One surface is hard, bony, and very rough and corrugate, with many large and small eminences and depressions. The opposite surface is slightly convex, its edges are raised and fluted, and the area within these raised edges is smooth and covered with a thin layer of cartilage. One pole of this body is broad, and the other comes to a point, and at this point there is attached, by a fibrous band, a very small spherical solid mass, in structure apparently similar to the bony part of the larger body. This small body is about 2 mm. in diameter and resembles a mustard seed. The joint was very carefully examined, but beyond a thickening of the synovial membrane there was nothing abnormal. The articular surfaces gave no clue as to the origin of the body.

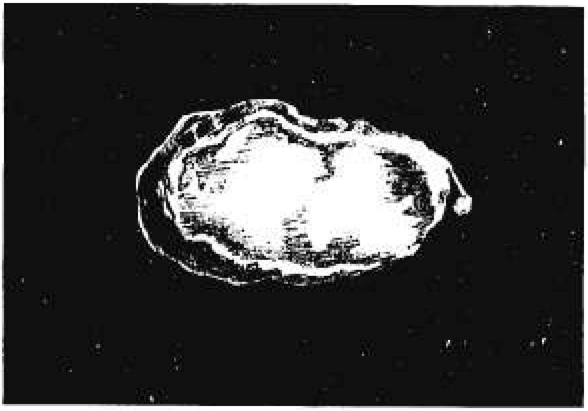

FIG. 4.

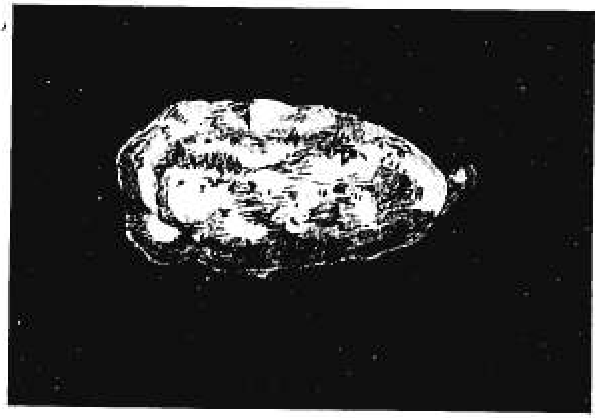

FIG. 5.

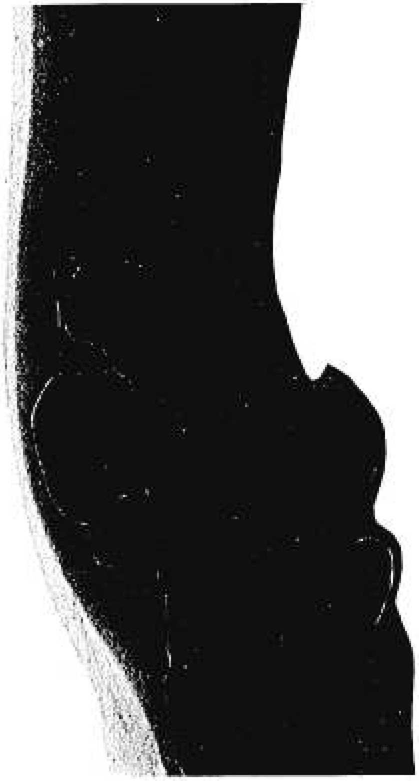

Fig. 6.

Upon inquiry, after the patient was convalescent, it was learned that he had, for many years, suffered with "rheumatism" of the right knee. He frequently had sudden attacks of sharp shooting pain in the joint, that would almost cause him to faint. With this intense pain, he could not move the joint nor even rest his foot upon the ground, but would have to lean against some stationary object until the pain had passed away. On more than one occasion he failed to catch a switching engine or car, because of this sudden pain which would make it impossible for him to move. In duration these attacks were always short. He never noticed any marked swelling of the joint, and after the attacks had passed away, he could go about his work as before, except that there would be some lameness, and that the joint might be sore and tender for some hours or days. He never had any trouble with the other knee, or any other joints. There was no history of any distinct traumatism.

A striking feature common to those two specimens is the smaller bony mass in connection with each. In review of the literature obtainable, reference to such small adherent particles is not found. Their significance is obscure; it would seem that they might be the origin of an additional body, and in the first case reported, where there was more than one body this explanation might seem tenable, but in the second case, it would seem that there had been ample time for a more advanced development of this second body. The presence of these smaller bodies in these two instances may be merely a coincidence, but if they are met with more frequently, they may be found to have a bearing upon the question of the formation of these floating bodies in the joints.

CASE III.—T. T., male, aged forty-one years, policeman, American. Previous History: Had most of the diseases of childhood, and "chills and fevers" when a youth in Missouri. When thirty-two years of age, had a severe attack of inflammatory rheumatism; all of the large joints were involved, the knee no more than others, with which he was confined to bed for six weeks. In his thirty-third and thirty-fifth years he had similar attacks of rheumatism, each of which lasted about six weeks.

Since then he has not been troubled with rheumatism or any other form of sickness. Present illness.—When fifteen years of age, he was riding horse-back, dismounted to open a gate, and in again mounting slipped and fell, but grasped a tug of the harness and was dragged along the ground head foremost for a distance of about twenty feet. He did not seem seriously injured, but there was a small triangular cut over the center of the right patella, as he remembers it this cut extended to the bone. The knee was somewhat swollen and slightly painful for a few days, during which time he remained in bed, and local applications were applied. In a week or ten days he had entirely recovered from the accident and was using the joint as usual.

About six months after this accident, he had his first attack of locking of the knee joint. While walking, feeling perfectly well, he experienced a severe sharp shooting pain in the right knee, which caused him to sink to the ground; he could not move the joint, but this pain and inability to move the joint soon passed away, and he was able to resume his walk. But there was considerable soreness remaining in the joint for a few days. Since then attacks similar to this one occurred at irregular intervals, four to six in a year, for a number of years. They never necessitated his being confined to bed.

About five years after the injury to his knee, there being no injury during the interval, he noticed the presence of loose movable bodies in the right knee. It seemed to him that there were many bodies in the joint, behind and on each side of the patella. They were about the size of a pea and some of them as large as a bean. He could feel them grate against one another or against the bones of the knee joint, and at times they would " pop " quite loudly, and would then cause moderate pain. Since first noting these movable bodies, he has always had trouble with the joint, has had " rheumatism," and the joint is a perfect barometer, always increasing in pain before the coming of a storm. The longest time that this knee has caused him to remain in bed has been about four or five days, only a few times. He admits, however, that he has many times hobbled around when it would have been much better for him had he rested. The use of strong liniment and the application of hot flannel cloths generally relieved the acute pain, and he was able to put up with the soreness.

About four years ago, the joint became ankylosed for about five days; this is the only time that such an occurrence has taken place. At present there is an almost constant pain when the joint is in action, but when at rest there is no pain. The limb remains a trifle flexed at the knee, and there is a slight eversion of the leg. The gait is very good, considering the pathology within the joint; it may be plainly seen, in walking, that one joint does not move as freely as the other. The patient states that the pain in the joint is much worse now, since these bodies became larger, than it was when the bodies were small, but he has not had the acute attacks of pain, with locking, for many years. The duties of a policeman are performed without any great apparent effort.

Examination: Well developed and nourished man, head, thorax, and abdomen negative. Both limbs of the same length, patella reflex normal on both sides. Left knee normal. Right knee ¾ of an inch larger than the left. Extension perfect, but extreme flexion is resisted and causes some pain. There is slight abduction of the leg. Passive and active motions of the knee are accompanied by crepitus. There is an effusion into the joint; the patella floats, but the normal depressions above and on each side of the patella are not obliterated. Palpation reveals a hard, resisting, movable mass about one half the size of the patella, situated below the tendon of the quadriceps extensor muscle. This mass can be moved laterally and also up and down, but only a small distance in either direction. It is not sensitive. A smaller body, about 1½ by ½ inches can also be felt; this body is freely movable and can be made to pass from the median line above the patella to the center of the right lateral aspect of the patella. This body is quite sensitive, and with its movements crepitus can be distinctly felt and heard. Sometimes this movable mass becomes lodged behind some muscular or tendinous structures and cannot be palpated, but some few maneuvers on the part of the patient can usually bring it within reach of the palpating fingers again. These are the only movable bodies that can be palpated but the patient states that occasionally a swelling can be felt in the popliteal space. The internal portion of the head of the tibia seems to be uniformly enlarged, and the tibial tubercle, the attachment of the patellar tendon, seems to be enlarged and extended laterally and superiorly, on each side of the patella. (See Fig. VI.)

CASE IV.—G. V., male, thirty-six years, laborer, Italian. Previous History negative. Present illness: Entered D. & R. G. R. R. Hospital, because of a simple fracture of both bones of the right leg at about the middle. In addition to the above, at examination there was found a swollen, tender and painful right knee joint. With the rest and immobility necessary in the treatment of the fracture the knee rapidly improved. After union of the bones and removal of the cast, the patient complained of some pain, soreness, stiffness, tenderness, and creaking in the joint upon motion. Examination of the knee revealed the presence of some fluid in the joint, a slight abduction with marked lateral motion of the leg, complete extension caused no pain, but flexion to a right angle caused pain, with crepitus that could be distinctly heard and felt. It was impossible to locate the seat of this crepitus, there was no acute pain with it, but when the leg was flexed the patient complained of pain which he located in the center of the popliteal space. On the external surface of the knee between the condyle of the femur and the articular surface of the tibia, there could be felt a mass about ½ inch wide and ¼ inch thick. This was movable; when pushed toward the center of the joint it seemed elastic and would spring back to its former position. The up and down and the anterior posterior motions were limited. The mass was not tender, nor was there any pain complained of when it was moved. Operation for removal of the body was advised but refused. Under rest and counterirritation, with pressure, the fluid was absorbed, the motion became much better, the abduction less marked, and the crepitus almost absent. But the mass could be palpated in the same position.

In the absence of operation and a presentation of the specimen, the propriety of including this case with the others may be questioned.

The mass in this case was certainly a movable body, outside of the joint, but its origin must have been within the joint; either from the articular surfaces or from the semi-lunar cartilages. After a careful study of the case I am constrained to class this with the three cases of Bennett's in which a piece of the semi-lunar cartilage is torn from its connections anteriorly and then pushed forward, in this manner producing a tumor readily felt under the soft parts. Usually when the semi-lunars are damaged they are forced into the joint, or retain their normal position. In these cases a part of the cartilages is forced outward, as is very well shown in Fig. VII, taken from Bennett.[25]

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